

Cerebrovascular Accident Associated with Dipyridamole Thallium-201 Myocardial Imaging: Case Report

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A patient with known aortoiliac occlusive disease and hypertension suffered a cerebrovascular accident 6.5 min after the administration of intravenous dipyridamole during a ^{201}Tl myocardial study. Despite aminophylline administration, the patient developed a completed stroke. The mechanism most likely responsible for precipitating this patient's stroke is dipyridamole-induced vascular steal. Although dipyridamole- ^{201}Tl myocardial imaging is relatively free of major complications, the morbidity and mortality associated with a cerebrovascular accident is significant. The possibility of precipitating a cerebrovascular accident during dipyridamole- ^{201}Tl imaging should be considered in all patients with significant risk factors for stroke before performing a dipyridamole cardiac study.

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Dipyridamole- ^{201}Tl myocardial scintigraphy is an effective and relatively safe technique for evaluating myocardial ischemia and infarct in patients unable to undergo stress thallium imaging (1-14). However, minor complications associated with administration of intravenous dipyridamole are relatively common and include chest pain, dyspnea, headache, dizziness, nausea, flushing, paresthesia, blood pressure lability, frank hypo- or hypertension, tachycardia, ventricular extrasystole, and ST-T wave changes on electrocardiogram (1-14). These complications are usually relieved by the administration of intravenous aminophylline. Major complications are rare but can be life-threatening. These include myocardial infarction, ventricular fibrillation, symptomatic ventricular tachycardia, bronchospasm, and anaphylaxis (1-14). Major complications are also frequently reversed by aminophylline administration.

Transient ischemic attack (TIA) and cerebrovascular accident (CVA) have been suggested as theoretical complications of intravenous dipyridamole, but cases docu-

menting their occurrence are virtually nonexistent (9,13). In this paper, we report on a case in which the administration of intravenous dipyridamole for ^{201}Tl myocardial imaging precipitated a CVA in a patient with no previous history of stroke.

CASE REPORT

A 63-yr-old white male with a history of insulin-dependent diabetes mellitus and claudication presented to our institution for workup of his aortoiliac occlusive disease. His presenting symptoms included recurrent pain after walking one-quarter block and burning over the dorsum and arch of his feet at rest. The patient had a history of hypercholesterolemia, chronic obstructive pulmonary disease, hypertension and a 150-pack-yr use of tobacco. The patient denied any history of CVA or TIA, decreased memory, unilateral motor weakness, numbness, monocular visual symptoms, or other neurological deficit. His medications included insulin, theophylline, enalapril, cimetidine, piroxicam, albuterol and beclomethasone.

On physical examination, the patient had normal vital signs and a normal cardiovascular exam; carotid artery bruits were absent. He had abdominal aortic and bilateral iliac bruits with near-absent pulses in both lower extremities. Dry gangrene was present in the fourth and fifth digits of his right foot. Motor and cognitive neurologic findings were normal as was an electrocardiogram.

As part of a preoperative workup for anticipated aortobifemoral bypass surgery, the patient underwent a dipyridamole- ^{201}Tl myocardial scan. Theophylline was stopped 48 hr prior to the examination. Six minutes following intravenous administration of 0.142 mg/kg/min of dipyridamole, the patient was injected with 3.0 mCi of ^{201}Tl . Thirty seconds later he began complaining of right-sided weakness, right facial droop and slow, unslurred speech. The patient was immediately reversed with 125 mg intravenous aminophylline. During the incident, the patient's blood pressure decreased minimally from 142/80 to 130/70 and his heart rate increased by 20%. These returned to baseline after aminophylline administration.

Unfortunately, the patient's right-sided neurologic symptoms worsened over the next 30 min. The imaging portion of this procedure was aborted because of the patient's continued waxing and waning neurologic exam and because administering aminophylline within 30 sec of thallium administration significantly decreases the sensitivity and specificity of this study.

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A carotid artery duplex ultrasound performed shortly after the incident demonstrated high-grade stenotic lesions of both internal carotid arteries. A cerebral angiogram confirmed significant right (75%) and left (85%) internal carotid artery stenoses. There was prompt antegrade flow through both stenotic lesions with normal intracerebral circulation.

Two days after the initial CVA, it was noted that the patient had worsening right facial numbness, profound right upper and lower extremity weakness with decreased light touch, pinprick, and proprioception, and decreased short-term memory capability. He underwent emergent left carotid endarterectomy.

Postendarterectomy, the patient's neurologic status stabilized but did not improve significantly. He was subsequently discharged to home with findings of a left-middle-cerebral-artery CVA with right facial droop and right upper and lower extremity signs and symptoms including weakness and diminished light touch, pinprick response, vibratory sensation, cold sensation and proprioception. In addition, right upper extremity drift, graphesthesia, stereognosis, and decreased short-term memory capability were present. The patient has had no further neurological episodes.

DISCUSSION

To our knowledge, CVA due to intravenous dipyridamole administration has not been documented previously. Pounds et al. (13) reported a case in which a patient experienced a TIA 25 min following the intravenous administration of dipyridamole but the patient had a significant past history of stroke and had multiple episodes of TIA for 3 mo after the documented ischemic event. Pounds et al., therefore, had difficulty temporally linking the ischemic event to dipyridamole administration.

The vasodilatory effect of intravenous dipyridamole on coronary arteries is maximum 6 min after administration (1,3). It is also at this time that blood pressure decreases, heart rate increases, and side effects caused by systemic vasodilatation occur (1,3). Our patient experienced onset of neurologic defects 6.5 min after dipyridamole administration, a time clearly within the window of expected maximum vasodilatation. The onset of neurologic deficits within this window of expected maximum vasodilatation strongly suggests a cause-and-effect relationship between dipyridamole administration and the CVA.

The mechanism which most likely precipitated this patient's CVA is intracerebral vascular steal. Pounds et al. (13) suggested that a dipyridamole-induced intracerebral steal phenomenon, similar to the vascular steal phenomenon seen in the heart following dipyridamole administration, could precipitate a transient ischemic attack. Coronary vascular steal occurs secondary to the vasodilatory effect of dipyridamole when blood is redistributed from an area of high fixed resistance such as a stenotic cardiac vessel to an area of low resistance such as a fully dilated vessel (2,11,13,16-18). We suspect that a similar mechanism produced significant hemodynamic changes within this patient's stenotic internal and vasodilated external carotid arteries. Redistribution of blood flow away from the highly stenotic left internal carotid artery would

lead to hypoperfusion within the distribution of the left middle cerebral artery and subsequent stroke. In essence, intracerebral vascular steal phenomenon precipitated the CVA.

Dipyridamole preferentially dilates coronary vessels; systemic vasodilatation is also substantial (2,9). It is unlikely, however, that systemic hypotension alone was responsible for precipitating the patient's CVA. Changes in blood pressure and heart rate were within the accepted range of normal (1,10,15).

Dipyridamole-²⁰¹Tl imaging is routinely performed on peripheral vascular disease patients prior to elective surgical procedures as a screen for cardiac disease that would make them a significant surgical risk (9,19-23). This patient population also has significant risk factors which predispose them to stroke such as diabetes mellitus, carotid artery stenosis, previous TIA or CVA, and hypertension. The risk-to-benefit ratio in patients with significant risk factors for CVA should be considered before performing dipyridamole-²⁰¹Tl imaging. Although infrequent, the morbidity associated with a CVA is significant.

REFERENCES

1. Homma S, Gilliland Y, Guiney TE, Strauss HW, Boucher CA. Safety of intravenous dipyridamole for stress testing with thallium imaging. *Am J Cardiol* 1987;59:152-154.
2. Iskandrian AS, Heo J, Askenase A, Segal BL, Auerbach N. Dipyridamole cardiac imaging. *Am Heart J* 1988;115:432-443.
3. Laarman G, Niemeyer MG, van der Wall EE, et al. Dipyridamole thallium testing: noncardiac side effects, cardiac effects, electrocardiographic changes and hemodynamic changes after dipyridamole infusion with and without exercise. *Int J Cardiol* 1988;20:231-238.
4. Lam JYT, Chaitman BR, Glaenger M, et al. Safety and diagnostic accuracy of dipyridamole-thallium imaging in the elderly. *J Am Coll Cardiol* 1988; 11:585-589.
5. Blumenthal MS, McCauley CS. Cardiac arrest during dipyridamole imaging. *Chest* 1988;93:1103-1104.
6. Scuderi AJ, Datz FL, Christian PE, Handy JE, Fortner AA, Morton KA. Dipyridamole thallium-201 myocardial scintigraphy. *J Nucl Med Technol* 1988;16:119-123.
7. Aksut SV, Port S, Collier D, et al. Dipyridamole thallium-201 myocardial imaging: complications associated with oral and intravenous routes of administration. *Clin Nucl Med* 1988;13:786-788.
8. Leppo JA. Dipyridamole-thallium imaging: the lazy man's stress test. *J Nucl Med* 1989;30:281-287.
9. The DuPont Merck Pharmaceutical Company. I. V. Persantine (Dipyridamole USP) Product Monograph: an alternative to exercise in thallium-201 myocardial perfusion imaging. Product Monograph 1990.
10. Ranhosky A, Kempthorne-Rawson J, et al. The safety of intravenous dipyridamole thallium myocardial perfusion imaging. *Circulation* 1990; 81:1205-1209.
11. Beller GA. Dipyridamole thallium-201 imaging: how safe is it? *Circulation* 1990;81:1425-1427.
12. Lette J, Cerino M, Laverdier M, Tremblay J, Prenovault J. Severe bronchospasm followed by respiratory arrest during thallium-dipyridamole imaging. *Chest* 1989;95:1345-1347.
13. Pounds BK, Moore WH, Ladwig EJ, et al. Dipyridamole thallium imaging. *J Nucl Med Technol* 1990;18:165-175.
14. Rockett JF, Magill HL, Loveless VS, Murray GL. Intravenous dipyridamole thallium-201 SPECT imaging: methodology, applications, and interpretations. *Clin Nucl Med* 1990;15:712-725.
15. Kahn D, Argenyi EA, Berbaum K, Rezai K. The incidence of serious hemodynamic changes in physically-limited patients following oral dipyridamole challenge before thallium-201 scintigraphy. *Clin Nucl Med* 1990; 15:678-682.
16. Wilcken DEL, Paoloni HJ, Eikens E. Evidence for intravenous dipyrida-

- mole (Persantine) producing a "Coronary steal" effect in the ischaemic myocardium. *Aust NZ J Med* 1971;1:8-14.
17. Feldman RL, Nichols WW, Pepine CJ, Conti CR. Acute effect of intravenous dipyridamole on regional coronary hemodynamics and metabolism. *Circulation* 1981;64:333-344.
 18. Gould KL. Coronary steal: is it clinically important? *Chest* 1989;96:227-229.
 19. Boucher CA, Brewster DC, Darling RC, Okada RD, Strauss HW, Pohost GM. Determination of cardiac risk by dipyridamole-thallium imaging before peripheral vascular surgery. *N Engl J Med* 1985;312:389-394.
 20. Cutler BS, Leppo JA. Dipyridamole ²⁰¹Tl scintigraphy to detect coronary artery disease before abdominal aortic surgery. *J Vasc Surg* 1987;5:91-99.
 21. Leppo J, Plaja J, Gionet M, Tumolo J, Paraskos JA, Cutler BS. Noninvasive evaluation of cardiac risk before elective vascular surgery. *J Am Coll Cardiol* 1987;9:269-276.
 22. Eagle KA, Singer DE, Brewster DC, Darling RC, Mulley AG, Boucher CA. Dipyridamole-thallium scanning in patients undergoing vascular surgery: optimizing preoperative evaluation of cardiac risk. *JAMA* 1987;257:2185-2189.
 23. Sachs RN, Tellier P, Larmignat P, et al. Assessment by dipyridamole-thallium-201 myocardial scintigraphy of coronary risk before peripheral vascular surgery. *Surgery* 1988;103:584-587.